

# BREWS & MICROSCOPY

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## ONE-DAY PRACTICAL WORKSHOP

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# BIOLOGICAL LIQUID AMENDMENTS

## Compost Extract

Process of **extracting** organisms and soluble nutrients from compost.

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## Compost Tea

Process of **brewing** a water extract of compost and **adding food supplements** to encourage **growth** of beneficial organisms.



# BIOLOGICAL LIQUID AMENDMENTS



What is the purpose of compost tea or compost extract?

To return the missing biology back into our soils.

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Why do we want biology in our soil?

When plants feed the microbes, the microbes also feed the plant.



# BIOLOGICAL LIQUID AMENDMENTS



## Similarity between the methods:

- Aerobic compost is used
- Process of making both amendments is aerobic

## Why not use anaerobic products?

- Phytotoxic compounds (harmful)
- Aerobic organisms form symbiosis with plants

## Required Components

1. Aerobic compost
2. Compost brewer
  - **Air pump** - ( $O_2$  should never be below 6 mg/L of  $H_2O$ )
  - **Fluid pump** (*optional*)
3. Microbial supplements or foods
4. 400 micrometer (or micron) mesh bag





# BIOLOGICAL LIQUID AMENDMENTS

## Compost Tea Production

1. Turn on brew
2. Add foods at the start of the brew
3. Let the brew run for ~5 minutes to dilute the food
4. Make extract
5. After 4 - 6 hours, remove the bag from the tank and let brew run for 24-36 hours
6. Check under scope every 8 hrs



# FACTORS TO CONSIDER FOR A SUCCESSFUL EXTRACT OR TEA:

- Test Compost
- Brewer **maintains aerobic** conditions → above 6 mg O<sub>2</sub> per L; no probe? Use scope or work with Jo
- Brewer actually extracts organisms from the compost
- Test microbial supplements – a little bit at a time
- Test liquid amendment. Check under scope



# FACTORS TO CONSIDER FOR A SUCCESSFUL EXTRACT OR TEA:

- Compost material in bag stays aerated and **not** compacted.
- Brewer tank must be **easy to clean** —————→ BACTERIAL BIOFILM CAN FORM
- Clean your brewer tank right after use
- Foam on surface tea doesn't mean it's a good thing

HOW DO YOU KNOW YOUR TEA OR EXTRACT  
WORKED?

Test the soil periodically

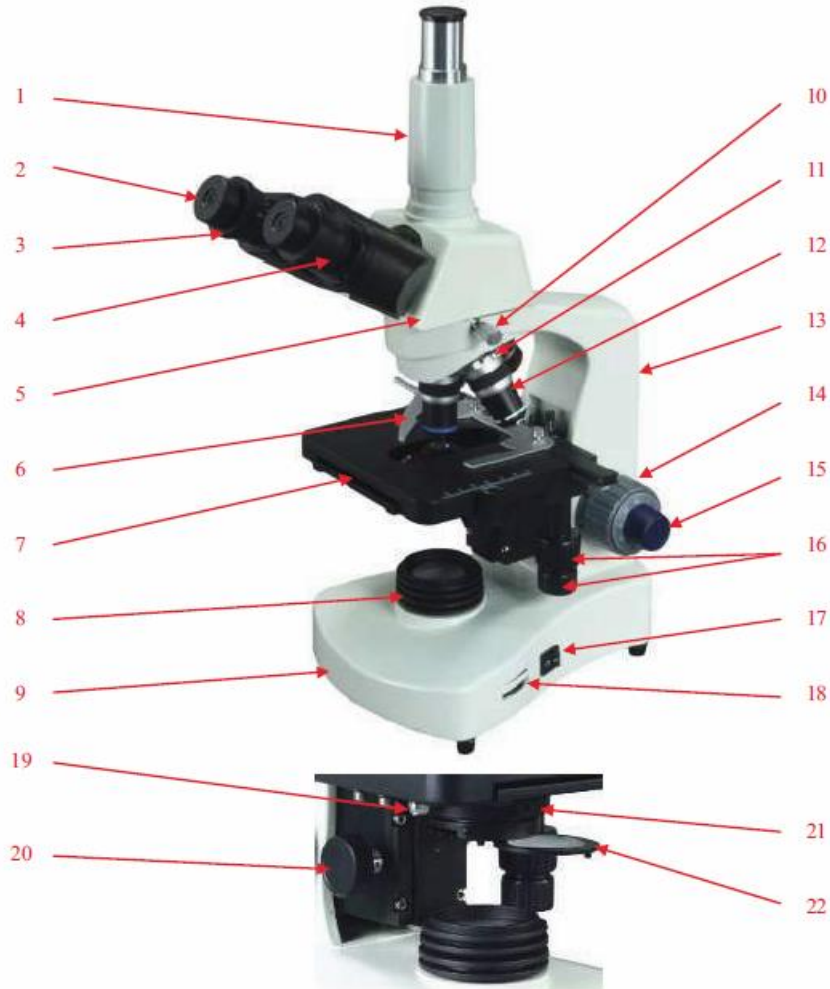
# BIOLOGICAL LIQUID AMENDMENTS

COMPOST TEA	vs	COMPOST EXTRACT
Foliar application		Soil application
Add foods at the start of the brew to grow beneficial organisms		No foods added at the start of the brew but can be added prior to soil application
Can use in soil with organic matter levels $\leq 3\%$ - foods added and dead organism bodies in brew act as organic matter		Soil organic matter level must be $> 3\%$



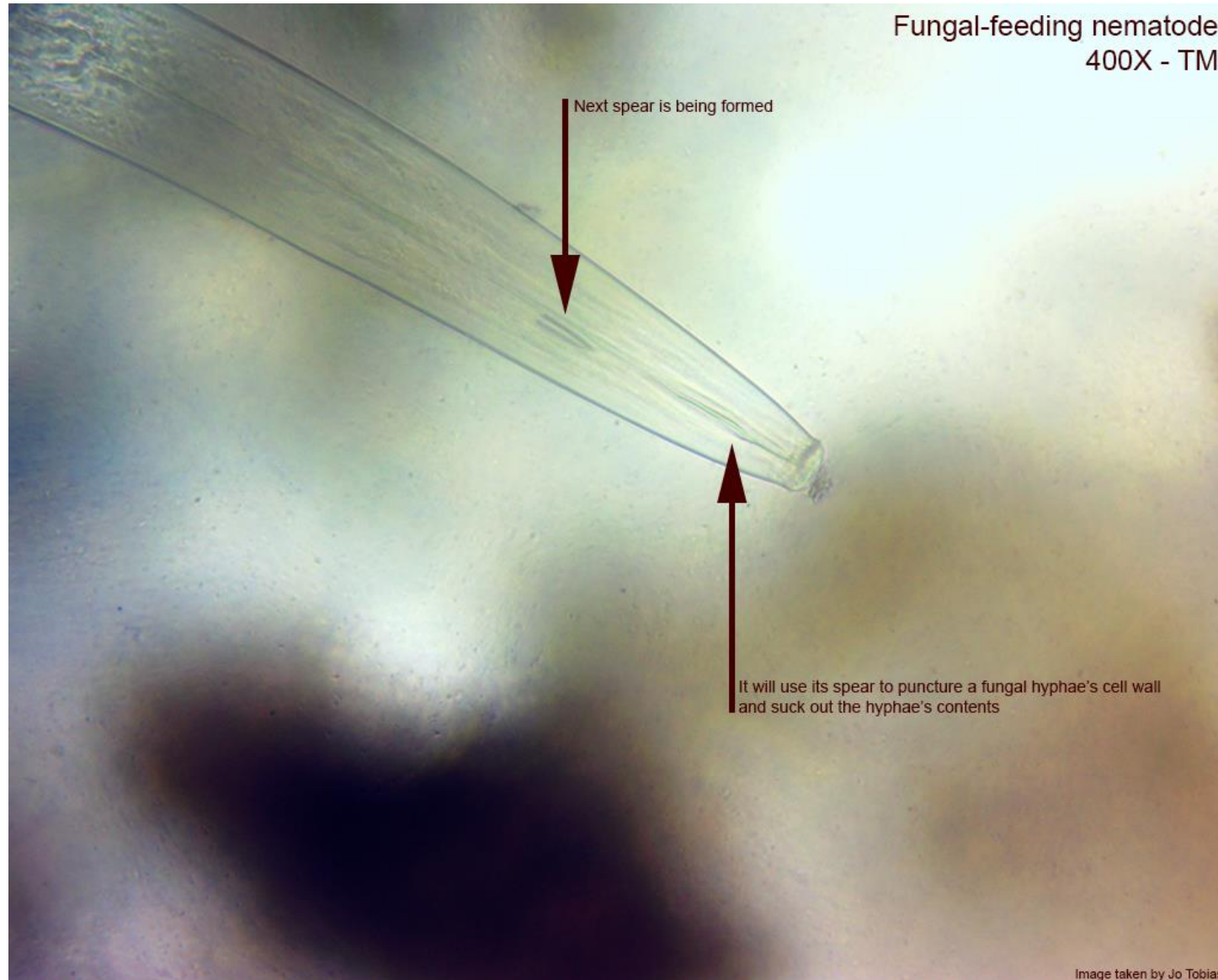
# MICROSCOPY

## BASIC ANATOMY



1. Compound light microscope with **shadowing capabilities** – Abbe condenser + iris diaphragm
2. Photo tube/camera mount
3. Ocular lense/eyepieces – use 10x
4. Objective lenses – 4x, 10x, 100x
5. Mechanical Stage and slide holder/clip
6. Stage Moving Knobs
7. Focusing knobs – coarse and fine
8. Light collector/illuminator

# PREDATORS

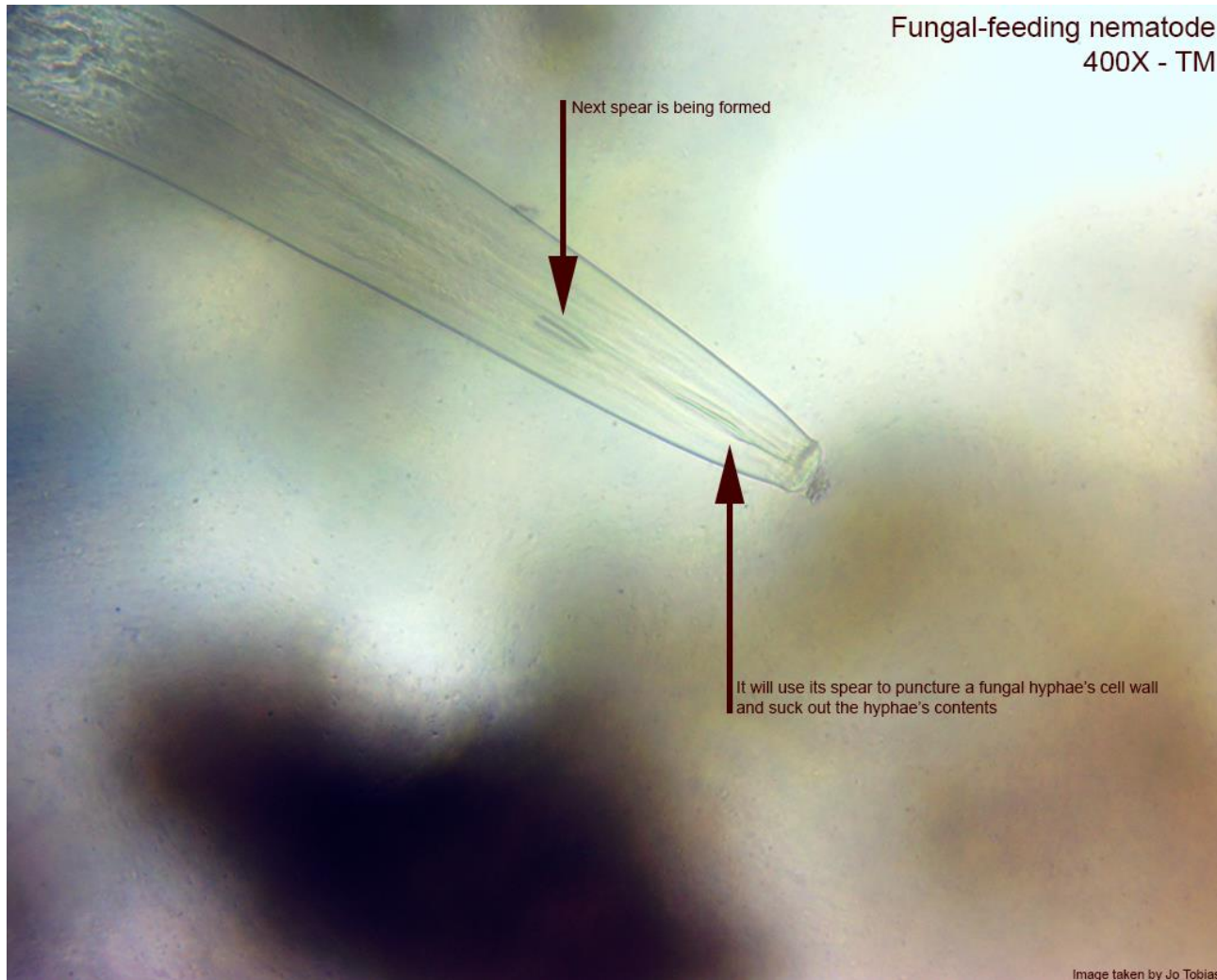


- **Protists** (amoeba, flagellates, ciliates)
- **Microarthropods**
- **Other**
- **Beneficial nematodes** (bacterial, fungal)

## ECOLOGICAL ROLES

- Nutrient cycling
- Microbe dispersal
- Food for higher level predators
- Stimulate activity of their prey
- Decomposition
- Disease and pest suppression

## SAMPLE ANALYSIS



1. Sample type
  - Soil or compost?
2. What plants were growing in the soil where the sample was collected from?
3. What plants do you want to grow?
4. When was the sample collected?



# ANALYZING SAMPLES



1. Set microscope at 4x magnification
2. Prepare sample
3. Look through eyepieces and adjust so you see a single circle of light with both eyes.  
That circle of light is a 'field'
4. Place sample on the stage
5. Move the stage so the field starts at one of corners of the cover slip
6. Begin analysis

## NEMATODE MORPHOLOGY

**Nematode Mouth Parts for ID (Zaborski)**

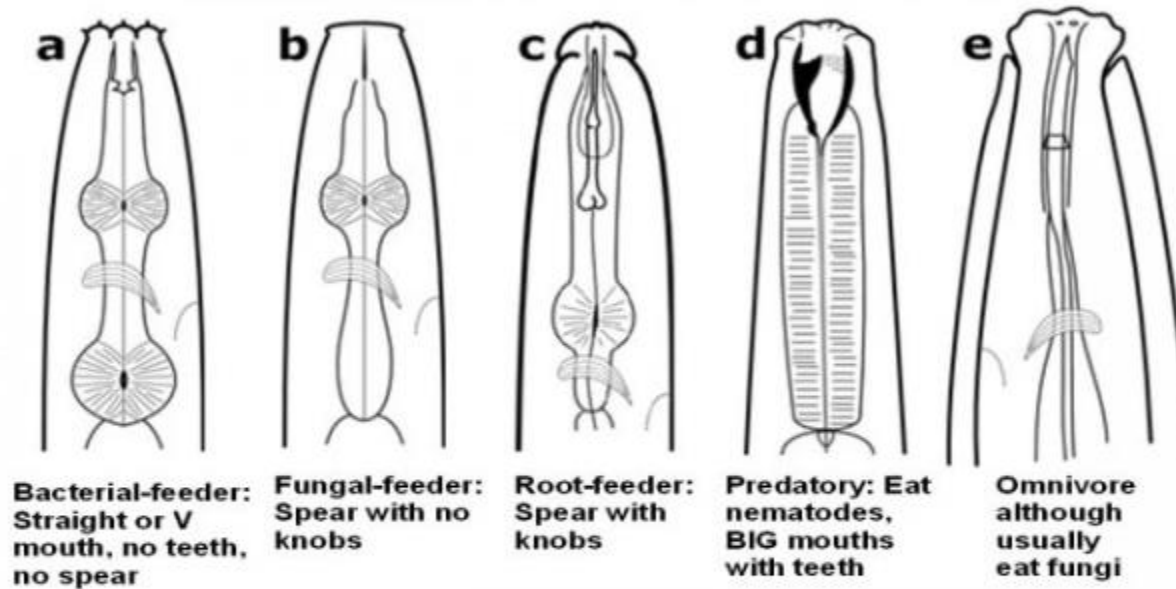
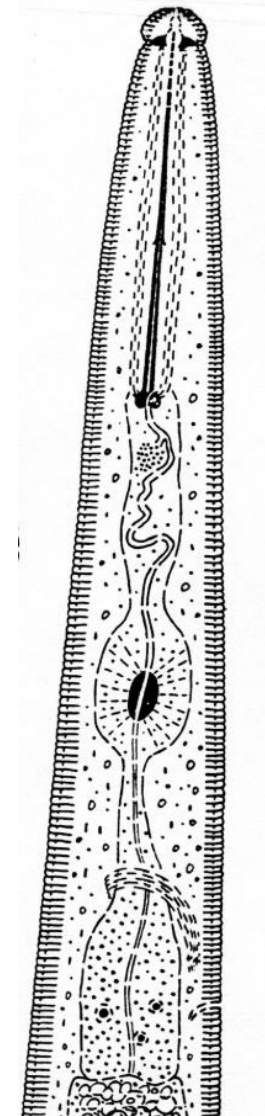


Image courtesy of Soil Foodweb Institute (Australia)

## PLANT-PARASITIC



Family: Criconematidae



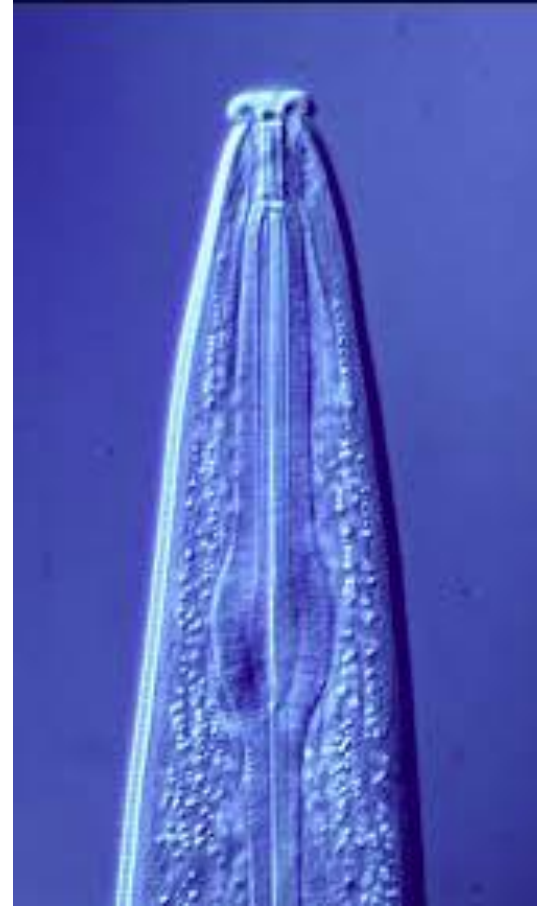
Family: Dolichodoridae



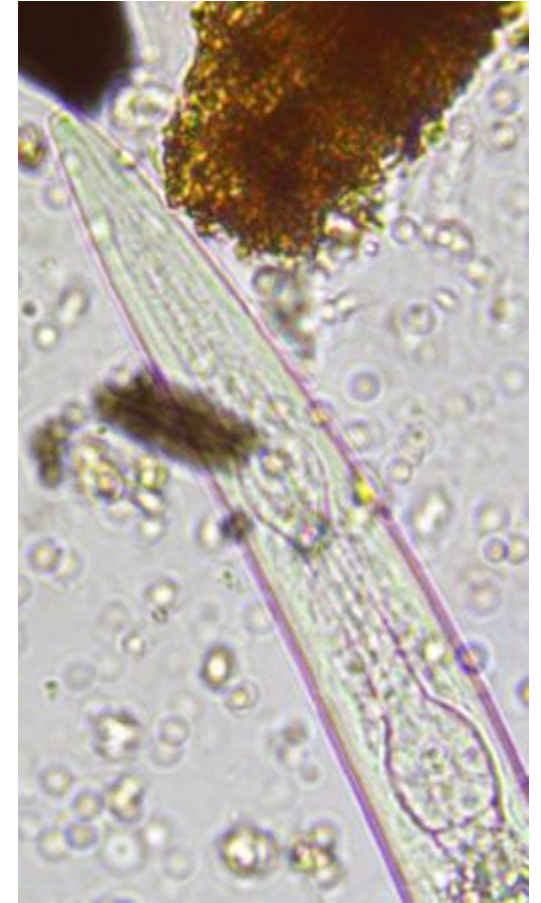
## NEMATODE – Bacterial Feeding



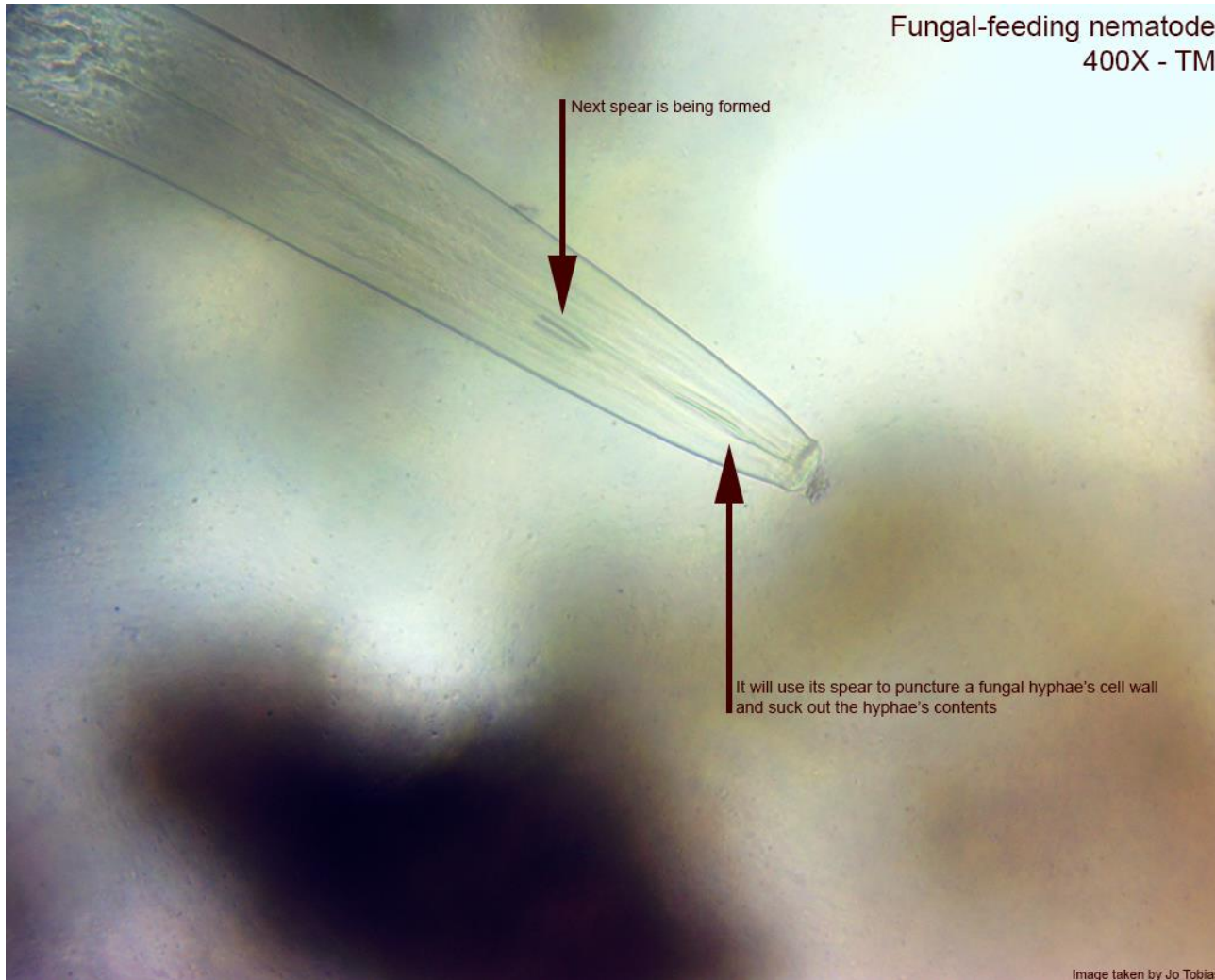
Family: Cephalobidae



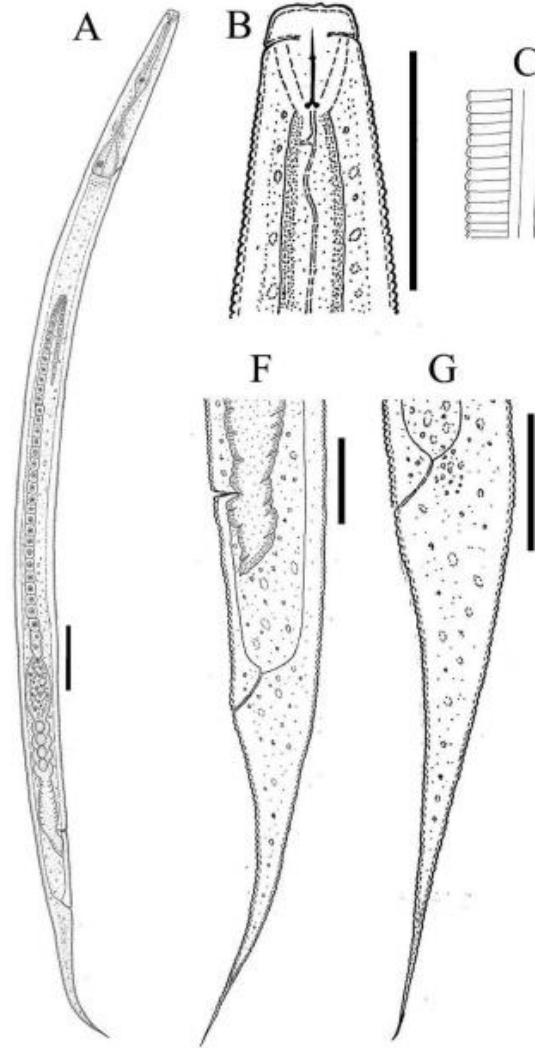
Family: Rhabditidae



# NEMATODE – Fungal Feeding

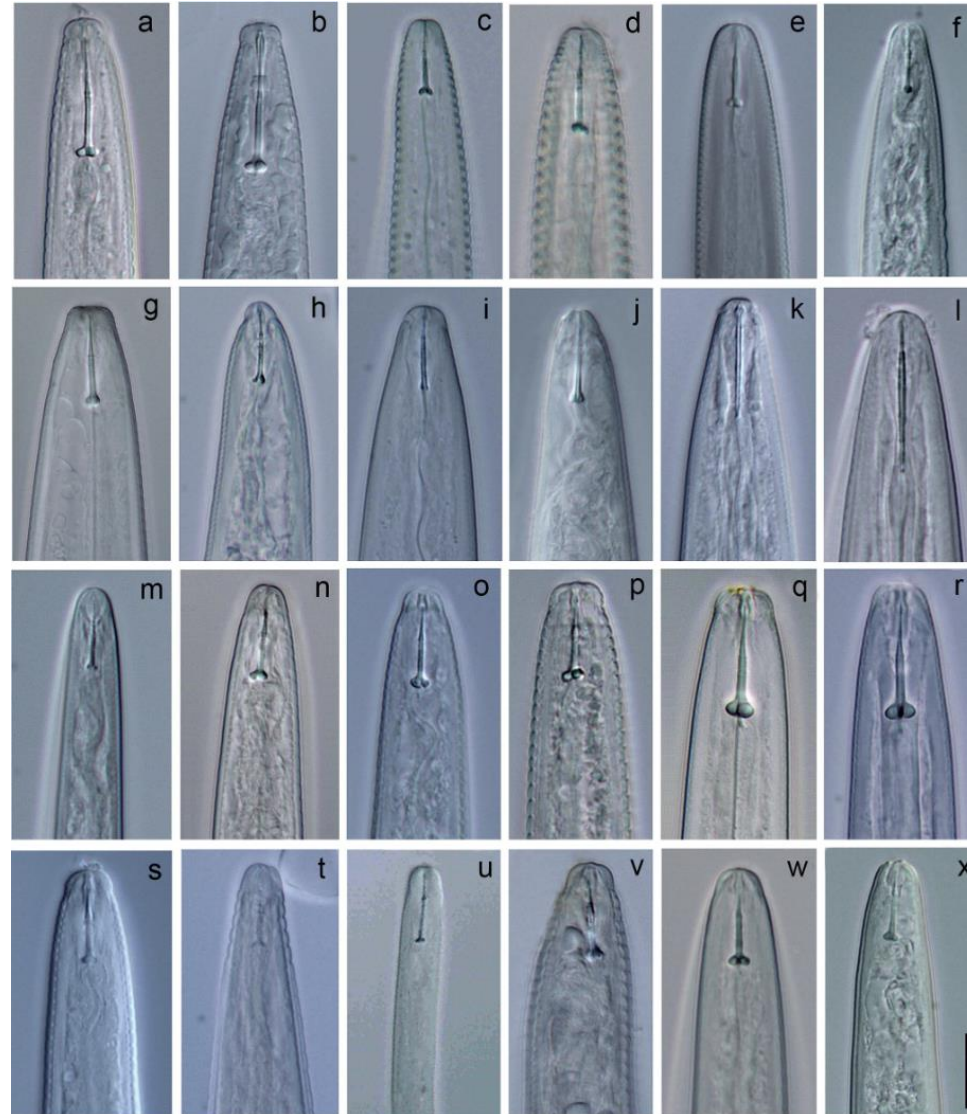


Family: Aphelenchoididae



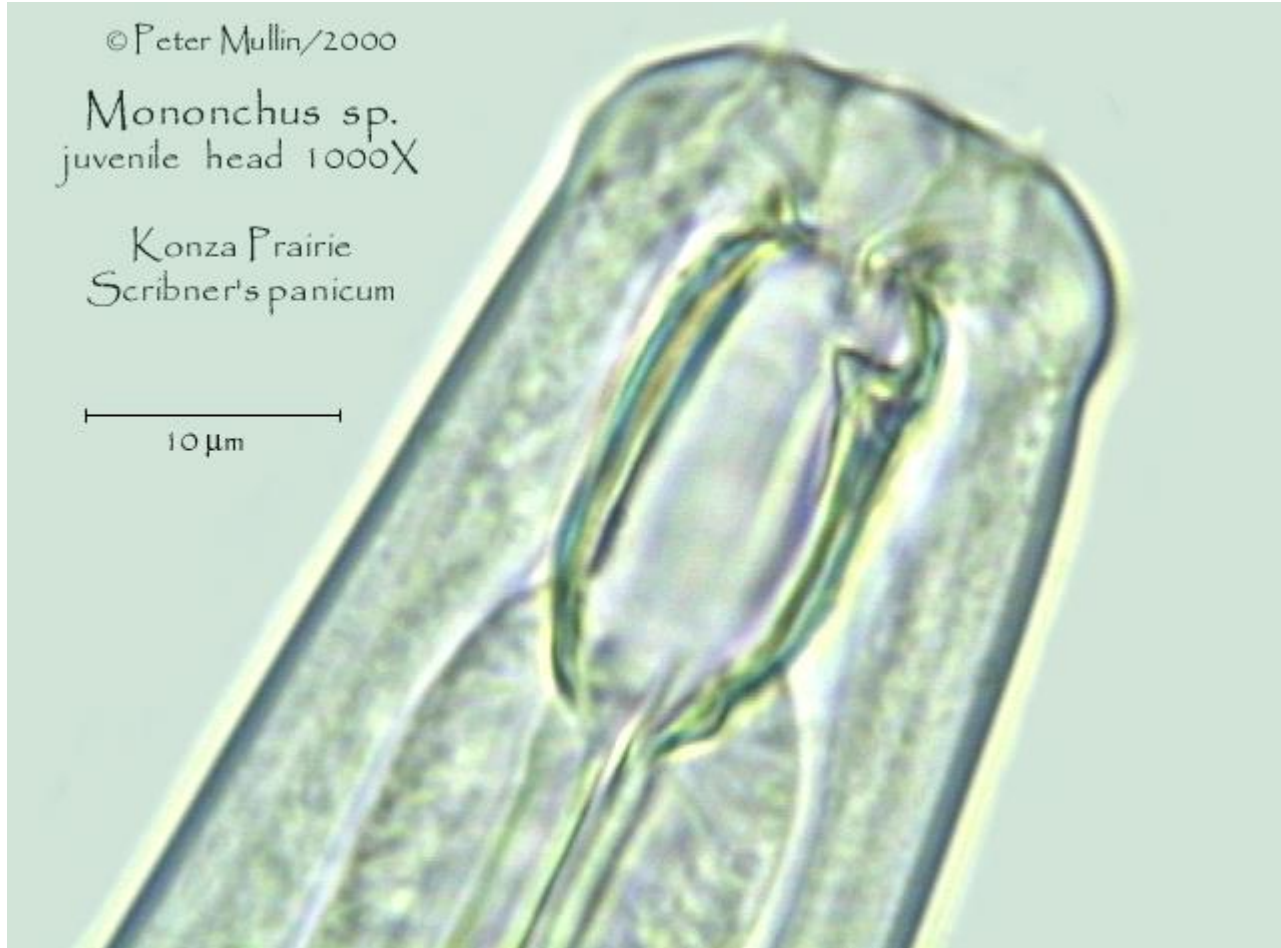
Family: Anguinidae

## NEMATODE – Plant & Fungal Feeding





## NEMATODE - Predator

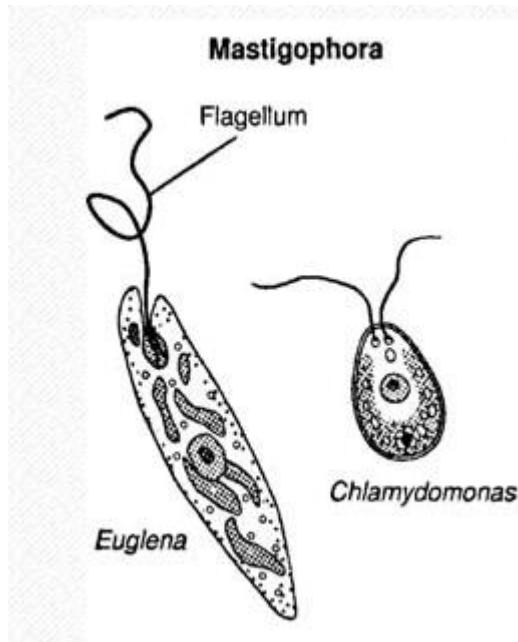


Family: Mononchidae



Family: Discolaimidae

## PROTOZOA



Flagellates

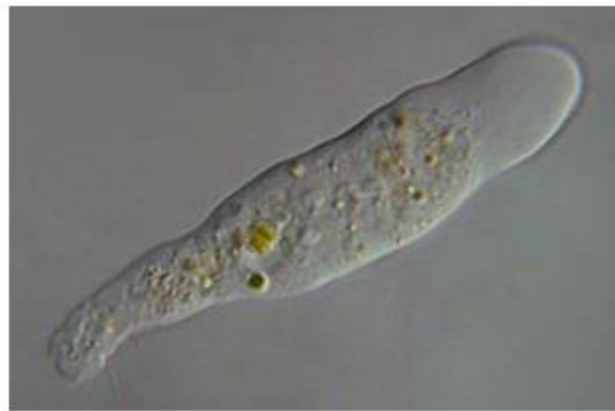
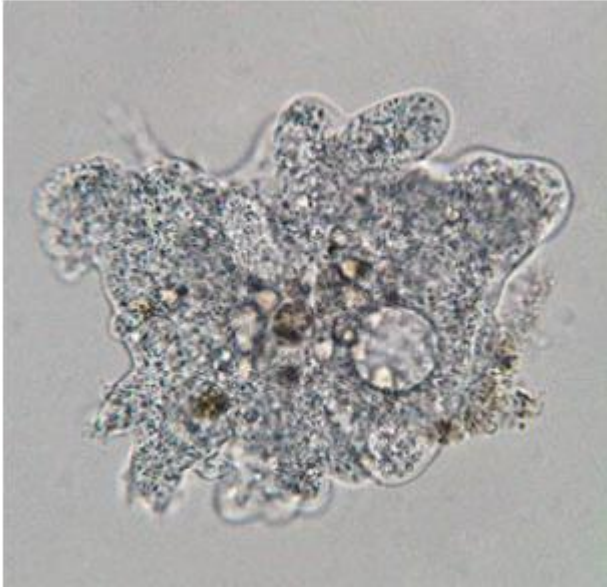
### Testate Amoeba





## PROTOZOA

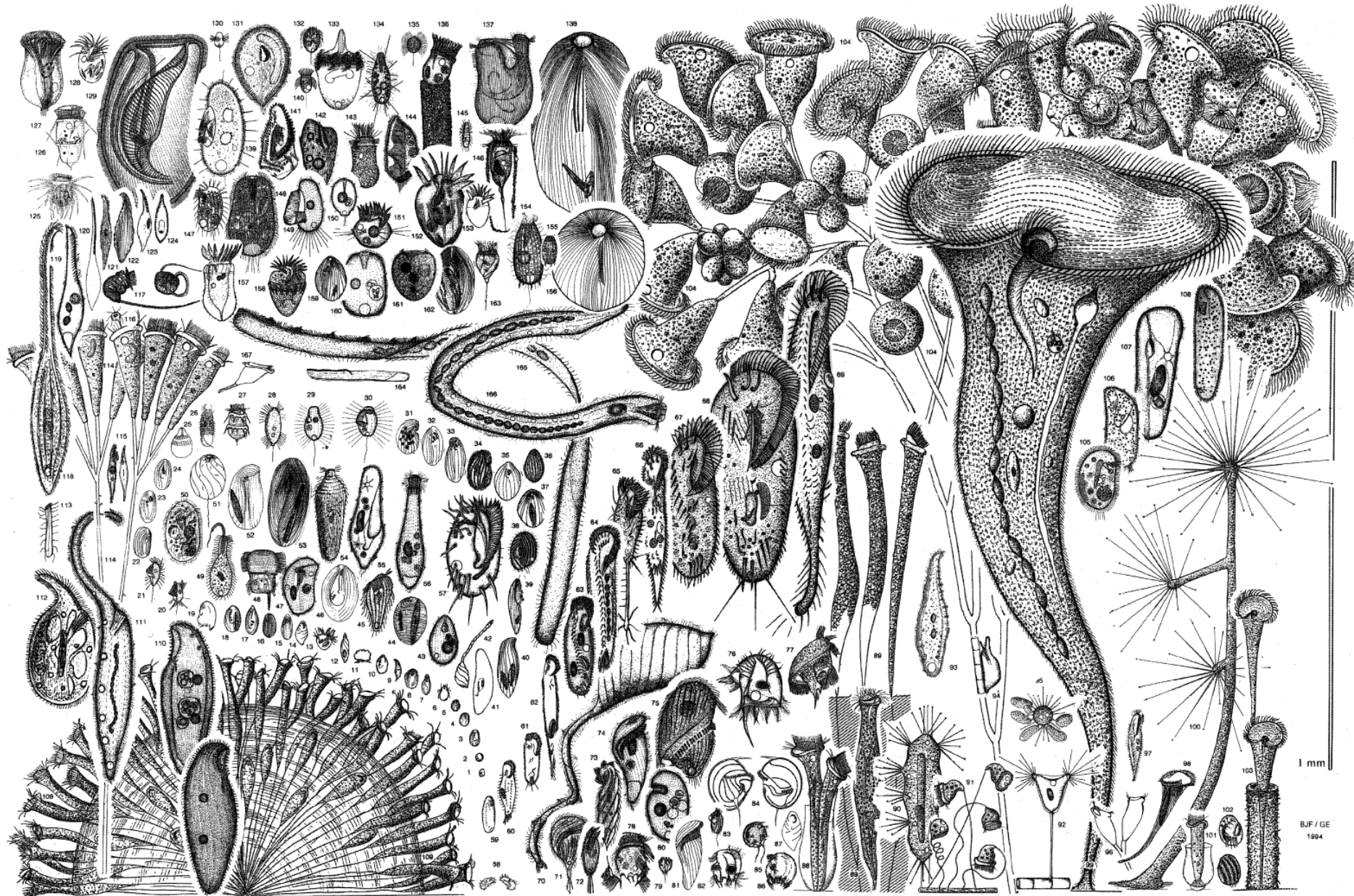
Naked Amoeba





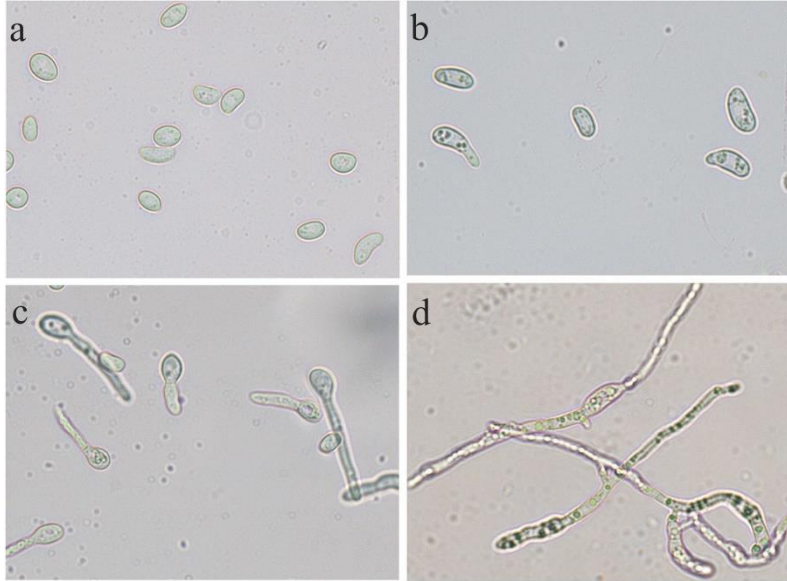
# MICROSCOPY

## Ciliates

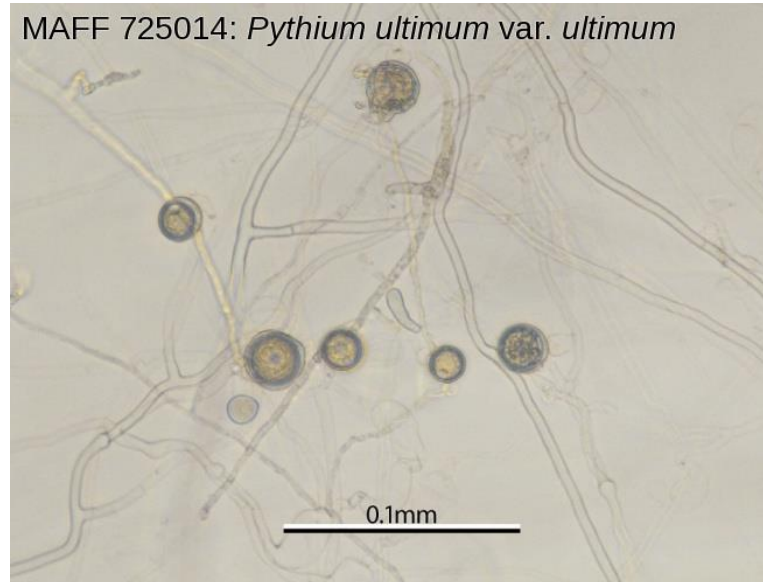




## FUNGI – Soil-borne diseases



*Fusarium oxysporum*



*Pythium ultimum*

- Clear/colorless hyphae
- Hyphae has irregular diameter
- Some lack septa others have adventitious

## FUNGI – Beneficial



- Hyphae has uniform diameter along the whole strand
- Colored hyphae: tan, honey, golden, red, brown
- Some that have clear hyphae have uniform septa